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Sustainable management

SUSTAINABLE MANAGEMENT OF RURAL-ECOLOGICAL COMMONS: RECOMMENDATIONS ON eDPSIR CAUSAL NETWORKS

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Abstract. This study aims to reveal the importance of the pastures as the rural-ecological commons in terms of biodiversity and ecological sustainability by focusing on the transformative impacts of the enclosure and commodification processes. Pastures are crucial especially within four dimensions: (1) rich biodiversity of flora and fauna; (2) rural development; (3) erosion prevention; and (4) rural tradition. Conflicts on the pastures and their triggering mechanisms are the main research interests of the study. Sustainable management of the rural-ecological commons has a potential to prevent the conflicts on the pastures. Three case study districts in Izmir (Turkey) are chosen to determine the conflicts on the pastures in relation with the recent legal regulations, determination, delimitation and allocation processes, malpractices and the civil responses. Data gathered from the interviews with professionals and village headmen, literature review, media analysis, and personal observations are evaluated by the content analysis to determine the main conflicts and the pasture dimensions for the eDPSIR **(**Driving force, Pressure, State, Impact, Response**)** model, which is an enhanced organisation tool to understand the multi-level relationships in environmental and social issues. The developed pasture dimension set evaluates the rural-ecological commons in relation with the actor relations and geographical aspects during the decision-making, common management and the planning processes.

Keywords: commons, pastures, enclosure movements, DPSIR, sustainable management.

AIMS AND BACKGROUND

This study aims to redefine the pastures as the rural-ecological commons, which are crucial for the ecological sustainability, biodiversity, CO_2 absorption, erosion prevention, and rural culture and tradition and promote their protection by improved legislations, reclamations and planning policies against the continuing conflicts and pressures by the enclosure and commodification processes in Izmir. Commons are the tangible and intangible spaces of the public use and collective ownership that belongs to society with a free access[1], which can be divided into two groups: ecological (e.g. air, water bodies, pastures) and civic commons (e.g.

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streets, public spaces, public transit) or the public goods[2]. Village common spaces contain ecological, manmade, tangible and intangible commons, including the village square, village fountain, cemeteries, picnic areas, pastures, threshing fields, village traditions, apparel types, dances and accents (Table 1).

Table 1. Categorisation matrix of the common types[3]

Commons	Rural commons		Urban commons	
	tangible	intangible	tangible	intangible
Natural/ ecological	pastures, rivers, forests and other natural resources	air, climate	rivers, seashores	air, climate
Artificial/ manmade	village square, picnic areas, village fountain, cemeteries	village traditions, apparel types, dances, music, accents	urban square, streets, public spaces, cemeteries, urban parks, urban forests, public transport	urban traditions, music, styles, software and information commons

Pastures contain many endemic plants and the protection of the pasture ecosystem is as crucial as the protection of the forests and deltas. Today, pastures in Turkey are under serious pressure of urbanisation and enclosure due to the changing legislations and malpractices. Pastures also contain the forage plants, covering 3.5 billion ha land, which is the 72% of the total agricultural land and 27% of the total land in the world. Pastures are irreplaceable natural resources, providing forage plants for husbandry and unique flora and fauna of the geography. However, most of the pastures are degraded due to overgrasing, undergrasing and dibbling activities, unsustainable reclamations and allocations to other uses. Pastures shrinked to 12.3 million ha in 2017, parallel to the increasing occupations by the rapid urbanisation, rural settlements, agricultural and mining activities in Turkey[4].

Pastures are the crucial natural resources included in the biosphere reserve, which need protection for their unique flora and fauna, resilience against the climate change and for providing free forage plants and being vulnerable cultural landscapes (Fig. 1) (Ref. 5).

Most of the land allocation demands are from the mineral extraction industry. However, the complete recovery of the allocated lands is almost impossible. Eventually, the loss of pastures results in the erosion and flood. A biocentric view to the pastures is necessary within the context of the commons, property rights and the use rights. The rental of the pastures to the private companies creates a clear conflict among the villagers and municipalities as many of the public lands used for grasing activities are easily enclosed. The legal gaps in Turkey resulted in the loss of many pastures; thus, within 67 years, pastures decreased from 42

million ha land to 12–13 million ha land, which is the approximately the 70% of the pastures within 50 years.

Fig. 1. Pasture – meadow, Golluce Village, Torbali, 2016

According to a media analysis data within the annual web-based archives in 2012–2017, pastures in Turkey encountered many land use conflicts from the construction, mining, energy and tourism sectors, public investments and governmental mass housing projects. Negative news that have location information are: occupations, energy investments, quarries, mines, barren pastures, less precipitation, allocation acts, agricultural uses, agricultural pesticides, bag bills, legal gaps, ambiguity of the Laws, organised stock industry zones, urbanisation pressure, food insecurity and inadequate pasture managements (Fig. 2).

Fig. 2. Negative news about the pastures in Turkey (2012–2016)

EXPERIMENTAL

In this study, case areas are chosen by the determined conflicts in terms of the rural-urban pressure and several other occasions. There are 50 in-depth interviews with village headmen from 54 total rural neighbourhoods. There are snowball interviews

and semi-structured interviews with the professionals and residents. Aliaga district has 19 villages that have a total population of 21 998 (2017); Bornova district has 12 villages that have a total population of 7759 (2017) and Torbali district has 23 villages that have a total population of 10 830 (2017). Population increase is determined in the villages of Bornova and Aliaga due to rural gentrification and prison construction (2012). Population decrease is determined in Torbali due to the rural-urban migration. According to the responses and the observations, primary conflicts in Aliaga are the housing occupations and the quarries (Fig. 3) (Ref. 6); primary conflicts in Bornova are the urbanisation pressure, occupation and the quarries (Fig. 4); and primary conflicts in Torbali are the quarries and the mines, as well as the highway and suburban railway constructions and public investments.

Fig. 3. Quarry, Caltilidere Village, Aliaga, 2017

Fig. 4. Occupation by village houses, Egridere Village, Bornova, 2017

Primary reasons for the pasture inefficiency are drought, rented unregistered pastures, geographical deficiencies, growing thorn population, air pollution, proximity to industrial areas, quarries, mines and conurbation, conflicting land

uses on pastures, limited number of grasing animals and husbandry activities and aging population. Content analysis is used to understand the main conflicts on the pastures and to specify the pasture dimensions. Subsequent to the data gathered from the interviews, eDPSIR causal network model is generated. Data sources are interviews, personal observations, maps, aerial photos, media analysis, statistical data, and expert opinion surveys within a group consensus workshop.

DPSIR (Driving force, Pressure, State, Impact, Response) is a causal analysis model used by European Environmental Agency (EEA) in its reporting activities, which is evolved from Organisation for Economic Cooperation and Development PSR model and United Nations Commission on Sustainable Development DPR model. The scheme is a functional tool to analyse the economic, social and natural systems, to identify the relations, policy options, and to evaluate the responses[7]. One of the main purposes of the model is the organisation of the information to communicate with the policy-makers.

DPSIR model theoretically provides the best insight into causality and accelerates the policy-making processes by easy feedbacks and available to be developed. Especially for natural assets and ecological commons, actors, power relations and social strategies strongly link to D-P process. Geography function and spatial strategies strongly link to S-I process, and eventually, the process results in R for a feedback (Fig. 5).

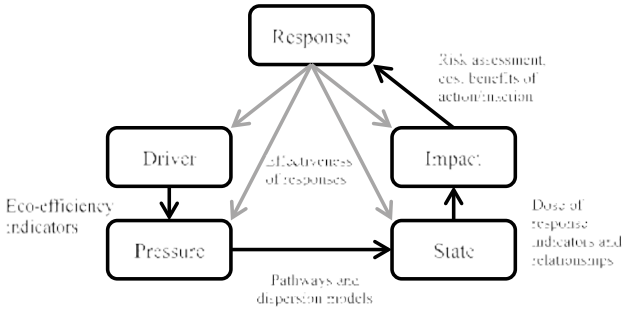

Fig. 5. DPSIR causal chain model[8]

There are two main approaches of DPSIR model: (1) state/impact oriented and (2) pressure-based, driver-oriented. First focuses on social responses to environmental state and impacts, while second focuses to monitor pressures caused by socio-economic driving forces[9]. Model can provide a database for the planning, design and decision-making processes for better communication with the decision makers. Environmental dimensions, actor-networks and geography dimensions can enhance the model.

RESULTS AND DISCUSSION

Dimensions that are used in DPSIR process involve a broad socio-economic and environmental system[10]. According to the general dimensions, a detailed DPSIR causal chain model of the pastures is generated according to the data gathered from the case studies and media analysis (Fig. 6). DPSIR causal chain model is criticised because of being a mechanistic over-simplification in terms of parameters. Although, this model helps to understand the environmental impacts caused by socio-economical driving forces, it cannot be adequate to grasp all multi-dimensional and multi-level relationships. On the other hand, enhanced DPSIR causal network model (eDPSIR) may give more insight about the complicated causality of the environmental indicators as it highlights the role of the mathematical techniques for quantitative exploration of the environmental dimensions[11].

Identifying the pasture dimensions and structuring the eDPSIR causal network model can help to evaluate the interrelationships among the causes and effects by using pressure interface and key nodes to find out the prioritisation of the policy-responses by expert opinion surveys. Pasture dimensions from the case studies and the media search contain 14 drivers, 11 pressures, 8 states and 11 impacts, which eventually creates 25 responses in order to eliminate these conflicts (Tables 2 and 3).

Table 2. DPSI pasture dimensions

Driving force	Pressure	State	Impact
1	2	3	4
(d1): False / inadequate mapping	(p1): Urbanisation	(s1): Brittle pastures	(i1): Degraded pastures
(d2): Indifference of authorities	(p2): Population increase	(s2): Brittle ecosystem and biodiversity	(i2): Loss of pastures
(d3) Changing legislations	(p3): Land allocation demands	(s3): Pollution	(i3): Decreasing number of animals and small farmers
(d4): Land occupation	(p4): Lack of infrastructure for pasture reclamation	(s4): Drought	(i4): Ageing farmers
(d5): Underground resources	(p5): Unsustainable reclamations	(s5): Increase in the thorn plant population	(i5): Degraded biodiversity
(d6): Agricultural and forestry uses	(p6): Inadequate water resources	(s6): Unprofessional farming	(i6): Desertification
(d7): Land fill uses	(p7): Barren lands	(s7): Land allocation to other uses	(i7): Degraded ecological sustainability
(d8): Public investments	(p8): Malpractices (overgrasing, etc.)	(s8): Rural poverty	(i8): Rural-urban migration
(d9): Lack of coordination among institutions	(p9): Pesticide use in agriculture		(i9): Rural gentrification

to be continued

Continuation of Table 2

1	2	3	4
(d10): Other initiative and investors	(p10): Lack of supervision		(i10): Decreasing CO_2 absorption
(d11): Weak agricultural policies	(p11): Lack of profit in husbandry sector		(i11): Food insecurity
(d12): Enclosure movements			
(d13): Uneven marketing prices			
(d14): Climate, precipitation, soil fertility			

Table 3. Responses to DPSI dimensions

Responses	Dimensions
(r1): Pasture registration	d1-d4-d5-d6-d7-d8-p3-s1-s2-s7-i2
(r2): Digital inventory	d1-d4-d6-d9-d12-p1-p3-p10-s7-i2
(r3): Pasture Management Unions	d2-d4-d6-p3-p4-p5-p8-p10-p11-s1-s6-s7-i1-i2-i3-i5
(r4): Sustainable pasture reclamations	d3-d4-d6-p3-p4-p5-p6-p7-p8-p11-s1-s2-s4-s5-s6-i1-i2-i5-i7
(r5): Technical infrastructure	d1-p3-p4-p8-s1-i1
(r6): Strict regulations	d3-d4-p3-p5-p10-s3-s6-s7-i2
(r7): Innovation of pasture fund	p3-p4-p11-s1-i1-i2
(r8): Cooperatives and unions	d11-d13-p3-p8-p10-s6-i3-i8
(r9): Protection of biodiversity	d4-d6-d14-p2-p3-p5-p7-p8-p9-s1-s2-s5-i2-i5-i6-i7-i10
(r10): Improving pasture quality	d14-p3-p4-p5-p7-p8-p11-s1-s2-s5-s6-s7-i1-i2-i3-i5-i6-i7-i10-i11
(r11): Basin-based production	d2-d3-d6-d10-d11-d13-p3-p11-s1-s2-s7-i1-i2-i5-i7
(r12): Grasing management	p3-p4-p5-p7-p8-p11-s1-s2-s5-s6-i1-i2-i3-i5-i10
(r13): Public disclosure	d2-d3-d4-d7-d10-d11-p3-p5-p8-p9-s6-s7
(r14): Bee pasture and apiculture	p3-p5-p9-s2-s3-s5-s7-s8-i5-i7
(r15): Artificial pastures by irrigation	p3-p4-i1
(r16): Subsidies and loans to farmers	d11-p11-s8-i3-i4-i8
(r17): Improving EIA reports	d1-d2-d3-d4-d5-d6-d7-d8-d9-d10-p3-p10-s7-i1-i2-i5
(r18): Shepherd certificate system	d11-p8-s1-s2-s6-i3
(r19): Workshops, panels	d2-p4-p5-p8-p9-s1-s6-i1-i2-i5-i6
(r20): Modern pasture reclamations	p3-p4-p5-p8-p9-s1-s2-s4-s5-s6-i1-i2-i3-i5-i6-i7
(r21): Education	d1-d2-d6-d10-d11-p3-p5-p8-p9-s3-s6-s7-i1-i2-i4-i6
(r22): Professional husbandry	d11-d13-p5-p11-s6
(r23): Remigration from urban to rural	d4-d11-p3-s7-s8-i4
(r24): Civil acts	d2-d3-d4-d5-d6-d10-d11-d12-p3-p10-s1-s3-s7-i2-i5
(r25): Restrain conflicting sectors	d1-d2-d3-d4-d5-d6-d7-d8-d9-d10-d11-d12-p1-p3-p10-s1-s2-s6-s7-i1-i2-i5

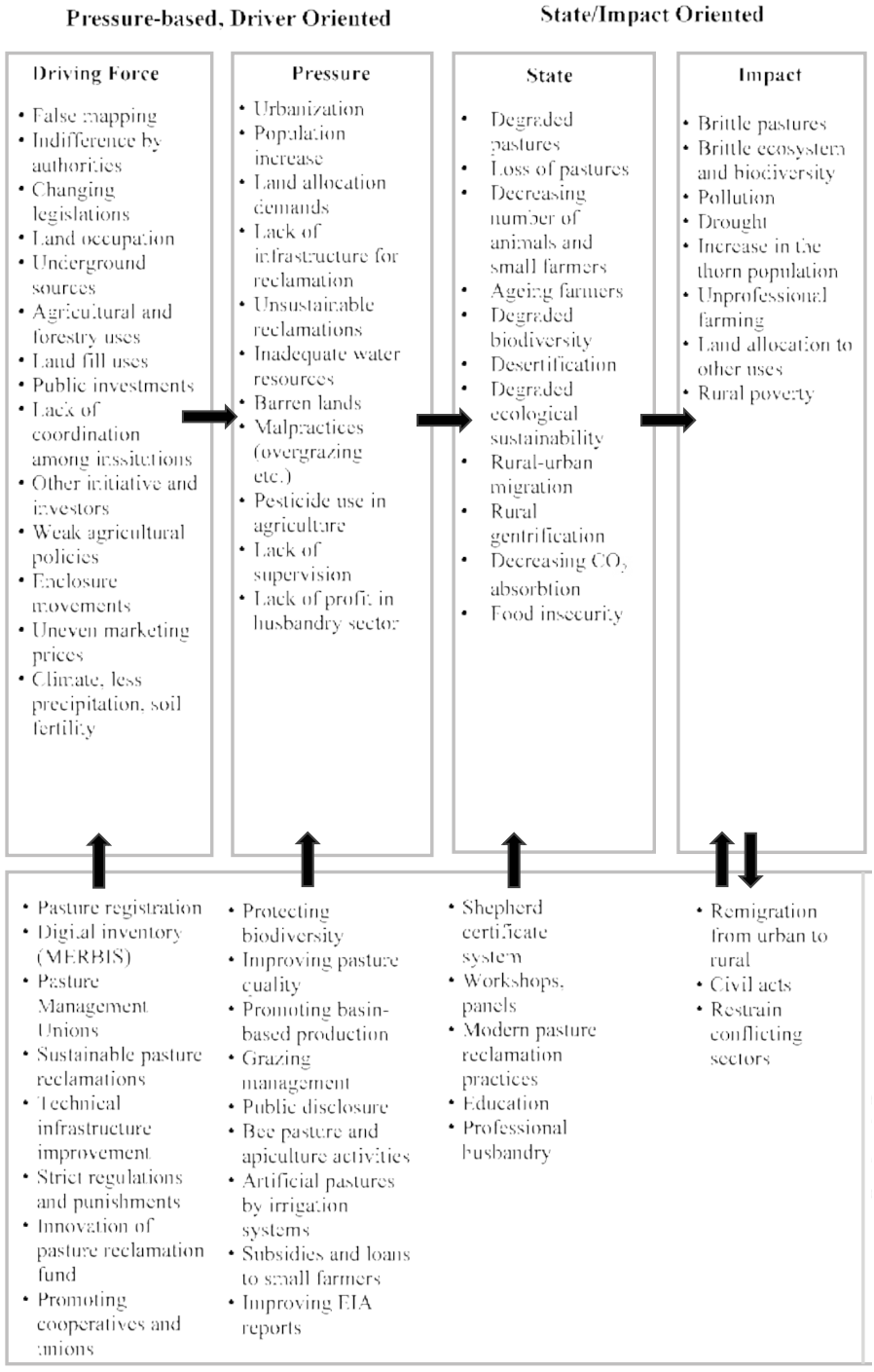

Fig. 6. DPSIR causal chain model of pastures, 2017

Model reveals that the Pressure Interface, as an economic sector or human activity that exerts a pressure on the environment, are malpractices such as appropriation to other uses, overgrasing, and the indifference of the authorities. Root Nodes, as mostly the causes of several environmental problems, are land occupation (d4), public investments (d8), and lack of coordination among institutions (d9). Central Nodes, as the web of cause and effects, are urbanisation (p1), Land allocation demands (p3), malpractices (p8), lack of profit in husbandry sector (p11), brittle pastures (s1), brittle ecosystem and biodiversity (s2), land allocation to other uses (s7), and rural poverty (s8). End of Chain Nodes, as the visible problems at the end of the process, are degraded pastures (i1), loss of pastures (i2), decreasing number of animals and small farmers (i3), degraded biodiversity (i5), and degraded ecological sustainability (i7) (Fig. 7).

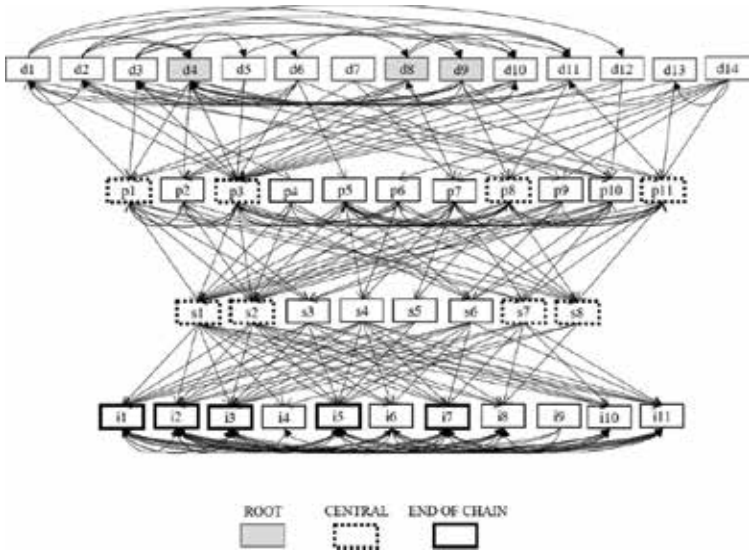

Fig. 7. eDPSIR causal network model of pastures, 2018

CONCLUSIONS

In this study, pastures are determined as the rural-ecological commons, which should be well defined within more biocentric land use decisions, relevant to the geographical, biological and physical characteristics that have multidimensional importance for the biodiversity, rural development, erosion prevention and rural tradition. Comprehensive conservation, planning and green belt policies may protect the pastures as being the alternative production and recreation areas. Alternative rural development strategies such as creative eco-tourism[12] and advanced agriculture and husbandry activities can improve the rural life quality and prevent especially the rural-urban migration of the younger villagers. Comprehending the planetary

value of the pastures is crucial to prevent the continuous allocation attempts. Promoting advanced pasture reclamations, grasing managements, monitoring by the technical teams and the rural development cooperatives can help to conserve these vulnerable lands that have high CO_2 absorption capacity which may create resilience against the climate change. For further research, adequate mapping of the pastures, monitoring the effects of the ecological thresholds are required, by using technical analysis tools such as GIS and Remote Sensing[13].

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